

# Atmospheric-Pressure Plasma Jet

Los Alamos National Laboratory and the University of California



***The Atmospheric-Pressure Plasma Jet (APPJ) produces a high-flux gas stream of reactive chemical species that can clean, decontaminate, etch, or coat surfaces—at atmospheric pressure and low temperature. Until now, such plasma treatments could take place only in vacuum. By spraying surfaces in the open air, somewhat like a fire extinguisher, the plasma jet can convert a vast range of organic residues or toxins into water vapor, carbon dioxide, and other nontoxic gases—in a minute or less. And unlike other atmospheric-pressure plasma sources, whose high temperatures limit their use to indiscriminate “burning” rather than selective chemical reactions, the plasma jet’s gas stream is cool enough to treat paper without scorching it.***

## ***Applications***

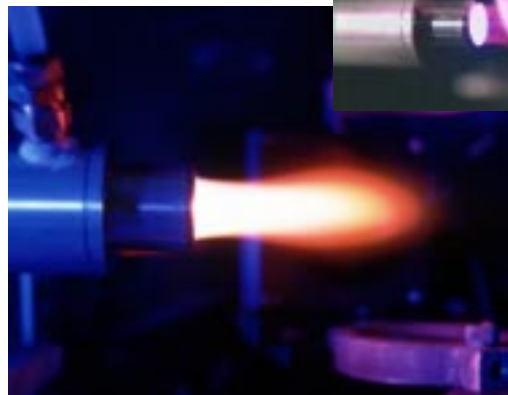
The APPJ technology can be used to

- clean steel draw rolls used to produce nylon;
- deposit silicon dioxide films onto plastics and other materials;
- remove photoresist from silicon wafers;
- etch polyimide, tungsten, tantalum, silicon, and silicon dioxide;
- make teflon wettable so that it can bond with other materials;
- remove graffiti; and
- decontaminate surfaces exposed to chemical or biological warfare agents or surfaces containing radioactive materials.

It also has the potential to be used for sterilizing food-processing and medical equipment, restoring art, and cleaning clothes and carpets.



Images show removal of spray paint from brick, ink from paper, and photoresist from a silicon wafer.



Shown here is the “round-jet” version which produces reactive chemical species in a gas stream (~1 cm in diameter). Above is a finger touching the torch.

## ***Benefits***

Use of the APPJ technology could

- cut time and cost and eliminate solvents in cleaning the steel draw rolls used to produce nylon or in processing semiconductor wafers;
- improve the taste and shelf-life of foods and beverages stored in plastic containers;
- remove graffiti without damaging underlying surfaces;
- allow equipment contaminated with chemical or biological warfare agents to be reused or contaminated areas to be reinhabited; and
- concentrate removed radioactive waste into a small filter.

## ***Cooperative research opportunities are available***

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